

A circular coil of wire consisting of 100 turns, each of radius 8.0 cm carries a current of 0.40 A. What is the magnitude of the magnetic field B at the centre of the coil?

Number of turns on the circular coil, $n = 100$

Radius of each turn, $r = 8.0 \text{ cm} = 0.08 \text{ m}$

Current flowing in the coil, $I = 0.4 \text{ A}$

Magnitude of the magnetic field at the centre of the coil is given by the relation,

$$|\vec{B}| = \frac{\mu_0}{4\pi} \frac{2\pi n I}{r}$$

Where,

$\mu_0 =$ Permeability of free space

$$= 4\pi \times 10^{-7} \text{ T m A}^{-1}$$

So,

$$|\vec{B}| = \frac{4\pi \times 10^{-7}}{4\pi} \times \frac{2\pi \times 100 \times 0.4}{r}$$

$$= 3.14 \times 10^{-4} \text{ T}$$

Hence, the magnitude of the magnetic field is $3.14 \times 10^{-4} \text{ T}$.